REPORT

ON

METEOROLOGY,

AND

HORTICULTURAL GARDENS,

IN THE PROVINCE OF OUDH.

FOR 1875-76.

LUCKNOW —*Printed at the* OUDH GOVERNMENT PRESS

193

No. 2550.

FROM

THE OFFG. PERSONAL ASST. TO THE CHIEF COMMR.,

OUDH,

TO

THE SUPERINTENDENT DEPARTMENT OF SCIENCE,

LUCKNOW.

Dated Lucknow, the 3rd June 1876.

SIR,

GENERAL DEPARTMENT.

I am directed to acknowledge the receipt of your Meteorological Report for 1875-76.

Para. 11.

2. The mean temperature was slightly lower, and the range 2·2 higher than in the year before. The monthly mean temperature was highest in June, *viz.* 92·3; this was, however, much lower than in May 1874, the hottest month of the previous year, when it was reported to be 97·1.

Para. 12.

3. Lucknow again appears in the returns as the coolest station in Oudh, and of the others Fyzabad the coolest, and Rae Bareli the hottest; as has been twice before remarked, this result cannot be accepted as reliable.

Para. 18.

4. There were four storms of no great severity during the year.

Para. 19.

5. The total rainfall was 43·8 against 51·1 during the previous year in Lucknow, and there appears to have been a sufficient fall through the Province, with the exception of the Unao and Kheri districts.

Para. 22.

6. Hail fell in nine districts out of twelve, but damage was done in the Kheri district only.

I have the honor to be,

Sir,

Your most obedient servant,

A. MURRAY,

Offg. Personal Asst. to the Chief Commissioner, Oudh.

PRINTED AT THE OUDH GOVERNMENT PRESS.

635·074
Ou 93

Meteorological Report for 1875-76.

Description of the Lucknow Observatory.

THE barometer in use is Casella's No. 648. It is suspended against a wall facing the north, in a room facing the north, adjoining the Museum building. The cistern is 369·4 feet above the sea level. This height has been computed from the Government Trigonometrical Survey's B. M., which is on the platform under the portico of the Museum. The barometer is corrected to the Kew standard, and the index error was obtained by Doctor Murray Thomson. The mean value of the barometric observations, up to the 5th November 1875, was computed from four six hourly observations, but since the 6th November it has been computed from the observations of 10 A. M. and 4 P. M.

2. The shade thermometers are suspended on a frame facing the north, under a thatched shed. The latter is situated in the middle of a large open piece of ground away from the influence of buildings and trees. They are on an average 5 feet 3 inches above the ground. The shed is surrounded on all sides, excepting the north, by "jilmils" to cut off side rays of the sun at the same time that free ventilation is allowed. The thermometers up to 2nd December 1875 were corrected to the standard in the Surveyor General's Office, Calcutta, but since the 3rd December 1875 observations have been taken by the standard thermometer No. 12682 furnished by the Meteorological Office Allahabad, and other thermometers corrected by it. I believe it is the intention of the Meteorologist to the Government of India to replace by degrees the old thermometers by new ones, compared with the standard of his office. The mean value of thermometric observations, up to the 5th November 1875 was computed from four six hourly observations, but since the 6th November it has been computed from the observations of 10 A. M. and 4 P. M.

3. The solar radiation thermometer up to 3rd January 1876 was exposed 8 inches above the ground, under a wire cage. From the 4th January 1876 it has been exposed on a special stand, furnished by Mr. Blanford, 3 feet above the ground.

4. The terrestrial radiation thermometer is exposed under the same wire cage, 5 inches above the ground. The soil is covered with grass, but it is dry during the hot weather.

5. Two rain-gauges have hitherto been in use,—a country made one, exposed near the thermometer shed 3 feet 6 inches above the ground, and one (Glaisher's) on the Museum terrace, 38 feet above ground. The mean annual amount of these two gauges was given. Since 8th April 1875, the lower one has been replaced by one of Symon's pattern, 6 inches above the ground. In future the mean of Symon's on the ground, and Glaisher's on the terrace will be given.

6. Robinson's anemometer is situated on the Museum terrace, the cups are 42 feet above the ground.

7. The following new thermometers received from the Meteorological office Allahabad have been in use from the following dates :—

Standard Thermometer in shade No. 12682, 3rd December 1875.
Dry Maximum in shade No. 8959, 5th December 1875.
Dry Minimum in shade No. 8887, 25th February 1876.
Wet Minimum in shade No. 8874, 9th December 1875.

8. The humidity is computed by Apjohn's formula up to 5th November 1875, from four six hourly observations, and from the 6th November 1875 from the 10 A. M. and 4 P. M. observations.

9. This report includes the period for the official year from 1st April 1875 to 31st March 1876.

10. The barometric pressure during the year was at its highest on the 9th December 1875 (29·854), and at its lowest on the 16th and 30th July 1875 (28·932). The mean pressure during the year was 29·391. The following table gives the comparison between the pressures of the present and previous year :— Barometric pressure.

	1874-75.	1875-76.
Mean ...	29·397 ...	29·391.
Maximum ...	29·808 December 20th ...	29·854 December 9th.
Minimum ...	28·943 June 25th ...	28·932 July 16th & 30th.
Range ...	·865 ...	·922

Monthly Mean Barometric Pressure.

April	1875	..	.. 29·298	October	1875	..	.. 29·475
May	„	..	.. 29·261	November	„	..	.. 29·629
June	„	..	.. 29·104	December	„	..	.. 29·672
July	„	..	.. 29·117	January	1876	..	.. 29·608
August	„	..	.. 29·213	February	„	..	.. 29·547
September	„	..	.. 29·304	March	„	..	.. 29·470

The mean value from April to October 1875 has been computed from four six hourly observations, and from November to March 1876 from the 10 A.M. and 4 P.M. observations.

11. The highest temperature in the shade during the year was 114·4 on the 4th June 1875, and the lowest was 36·2 on the 15th January 1876. The mean temperature of the year can only be approximately given, as the monthly means from April to October were computed from four six hourly observations, and from November to March from the Temperature in shade.

observations of 10 A.M. and 4 P.M. The means of the hourly observations of the latter months were as under, and by substituting these, the approximate mean of the year 78·1 is obtained :—

	1874-75.	1875-76.
Mean	78·5	78·1.
Maximum	115·3 May 10th	114·4 June 4th.
Minimum	39·3 January 23rd ..	36·2 January 15th.
Range	76·0	78·2.

Monthly mean temperature in the shade.

April 1875	89·7	October 1875	77·8
May „	90·5	November „	76·4
June „	92·3	December „	69·7
July „	88·0	January 1876	67·9
August „	83·6	February „	74·5
September „	84·0	March „	82·5

June and July of 1875 show a higher mean temperature than the corresponding months of 1874, and November and December 1875 and January and February 1876 show a much higher mean temperature than the corresponding months of 1874-75. The difference in the latter four months is, no doubt, partially due to the observations having been taken at 10 A.M. and 4 P.M. instead of six hourly observations. The mean temperatures of the same months taken from *hourly* observations, four times a month, are as under :—

November 1875	70·5
December 1875	64·5
January 1876	56·2
February 1876	66·1
March 1876	74·2

Civil Dispensary Registers.

12. The following are the mean annual temperatures taken from the registers of the Oudh Sadr Dispensaries :—

Unao	88·2	Hardoi	86·9
Bara Banki . ..	83·1	Kheri	86·7
Fyzabad	79·3	Rae Bareli	89·6
Gonda..	81·6	Sultanpur	88·3
Bahraich	79·5	Partabgarh	86·7
Sitapur	80·9		

These means are computed from observations taken at 10 A.M. and 4 P.M.

13. The highest temperature in the sun's rays during the year (vacuum maximum thermometer black bulb) was 165·1 on the 17th April, and 26th and 27th May and 3rd and 21st June 1875. The lowest maximum temperature was 82·1 on the 11th August 1875, and the mean of all the maxima was 141·2 :— Temperature in sun's rays.

	1874-75.	1875-76.
Mean	.. .. ..	141·2
Maximum	167·2, May 25th 1874.	165·1 April 17th, 26th and 27th May, and 3rd and 21st June 1875.
Minimum	.. .. ..	82·1 August 11th.
Range	.. .. ..	83·0

Monthly means of maximum temperature in sun's rays.

April	1875	155·8	October	1875	139·9
May	„	157·1	November	„	134·3
June	„	144·5	December	„	125·4
July	„	144·6	January	1876	130·7
August	„	133·0	February	„	141·6
September	„	137·0	March	„	150·3

14. The highest minimum temperature on the grass during the year was 83·1 on 8th June 1875, and the lowest was 32·4 on 14th January 1876. The annual mean of all the minima was 61·0 ;— Temperature on grass at night.

	1874-75.	1875-76.
Mean	61·5	61·0
Maximum	86·4 May 29th ..	83·1 June 8th.
Minimum	28·7 January 23rd ..	32·4 January 14th.
Range	57·7	50·7

Monthly means of minimum temperature of grass radiation.

April	1875	65·5	October	1875	59·5
May	„	71·1	November	„	45·9
June	„	78·5	December	„	43·8
July	„	77·0	January	1876	41·8
August	„	74·7	February	„	44·7
September	„	74·3	March	„	55·8

Humidity.

15. The highest degree of humidity was ·979 on the 14th September, and the lowest was ·087 on the 12th May 1875. The mean degree of humidity for the year can only be approximately given, for reasons given under the head of "temperature in shade,"—

	1874-75.	1875-76.
Mean	·626	·607
Maximum	·996 June 15th ..	·979 September 14th.
Minimum	·100 May 19th ..	·087 May 12th.
Range	·896	·912

Monthly mean humidity.

April	1875	.. ..	·321	October	1875	.. ..	·661
May	„	.. ..	·434	November	„	.. ..	·478
June	„	.. ..	·580	December	„	.. ..	·497
July	„	.. ..	·739	January	1876	.. .	·405
August	„	.. ..	·846	February	„	.. ..	·292
September	„	.. ...	·820	March	„	.. ..	·290

For reasons given above, the mean humidity from November 1875 to March 1876 is much lower than that of the previous year, and therefore the means of those months for the two years are not comparable. The mean humidity of these months, taken from the hourly observations four times a month, is as follows :—

November	1875	·634
December	„	·735
January	1876	·645
February	„	·453
March	„	·411

Clouds.

16. There were 245 more or less cloudy days throughout the year. The most cloudy months were July, August, and September.

Wind.

17. The prevailing wind was W.-N.-W. The most windy month, that is, in which the largest number of miles of wind passed by the Observatory at Lucknow was July 1875,—

	Direction of wind.																Variable.	Out of gear.	Total.	Total number of miles of wind during the year.
	N.	N N E.	N E	E N E.	E.	E S E.	S E.	S S E.	S.	S S W.	S W.	W S W.	W.	W N W.	N W.	N N W.				
Total.	292	242	112	100	612	794	320	313	366	202	230	265	936	2,723	967	256	42	8	8,784	26,172

It is the intention of the Meteorologist to the Government of India to supply the Lucknow Observatory with one of Beckley's self-registering anemometers. This will be a great addition, as the records of the present instruments are not sufficiently accurate.

18. There were four storms during the official year. The highest pressure recorded was 3lbs. in that which occurred on the 18th May 1875 :— Storms

Month and date	Hour.	Duration.	From which direction.	Mean barometeric pressure during storms (reduced)	Total velocity of wind (in miles)	Maximum pressure of wind during storms.	Accompanying phenomena
	H. M.	H. M.					
May 2nd ...	19·20	0 40	N.-W.	29 304	...	1½lbs	Lightning and thunder.
„ 18th ...	15·30	1 30	Do	29·376	17	3lbs	Very much dust, few drops of rain and thunder.
„ 24th ...	20·15	0 30	N.-N.-W.	29 278	10	2½lbs	Very much dust and lightning.
June 19th ...	15·30	0·30	N.	29·132	6	1lb.	Much dust

* Robinson's anemometer out of order

19. The total rainfall throughout the year recorded at the Lucknow Observatory was 43·876. The month in which most rain fell was August 1875 ; and the months in which there were most rainy days were August and September 1875 :— Rainfall—Lucknow Observatory

Month.		Rainfall.
April	1875	..
May	„	..
June	„	0·807
July	„	8·306
August	„	19·713
September	„	14·035
October	„	..
November	„	..
December	„	0·2
January	1876	0·1
February	„	..
March	„	0·715
	Total rainfall	43·876

Rainfall from district registers.

20. The following is the rainfall recorded at the various Sadr Dispensaries in Oudh for the year 1875-76 :—

Dispensary.	Rainfall.	Dispensary.	Rainfall.
Unao..	24·5	Hardoi	38·2
Bara Banki	34·8	Kheri	26·85
Fyzabad	34·0	Rae Bareli	32·7
Gonda	40·5	Sultanpur	47·0
Bahraich	34·7	Partabgarh..	40·4
Sitapur	30·6		

Floods.

21. There does not appear to have been any extensive floods in Oudh during the year 1875-76 :—

Districts.	Month and date.	Remarks in district returns.
Lucknow	1875 ..	All the low lands were submerged, and all "dhan" crops lost.
Unao..	*Nil* ..	*Nil.*
Bara Banki	*Nil* ..	*Nil.*
Fyzabad	*Nil* ..	*Nil.*
Gonda	*Nil* ..	*Nil.*
Bahraich	*Nil* ..	*Nil.*
Sitapur	*Nil* ..	*Nil.*
Hardoi	*Nil* ..	*Nil.*
Kheri	*Nil* ..	*Nil.*
Rae Bareli	*Nil* ..	*Nil.*
Sultanpur	*Nil* ..	*Nil.*
Partabgarh	Not mentioned,	Some damage was caused to the kharíf crops.

22. The following table shows the districts where hail fell during the year 1875-76 :— Hail.

Districts.	Month and date.	Remarks.
Lucknow	30th January; 16th February; and 9 and 10th March 1876 ..	No damage was done.
Unao	9th March 1876 ..	No damage was done.
Bara Banki	9th and 10th March 1876,	Not mentioned.
Fyzabad..	*Nil* ..	*Nil.*
Gonda	Not mentioned ..	It was little injurious.
Bahraich	9th and 10th March 1876,	It was not injurious.
Sitapur	*Nil* ..	*Nil.*
Hardoi	10th March 1876 ..	It was of no consequence.
Kheri	2nd and 3rd January and 10th March 1876..	Considerable damage has been done.
Rae Bareli	Not mentioned ..	No damage was done.
Sultanpur	*Nil* ..	*Nil.*
Partabgarh	March 1876 ..	It was not injurious.

Abstract of meteorological observations taken at the Observatory Lucknow for the year 1875-76.

	Atmospheric pressure.	Temperature in shade.	Wet bulb	Dewpoint.	Vapour tension.	Relative humidity saturation=1 000	Maxima in sun's rays.	Dry maximum in shade.	Dry minimum in shade	Wet minimum in shade. *	Minimum on grass.	Ozone.	Range of thermometer in year between maximum in sun's rays and minimum on grass.	Wind. Horizontal velocity	Wind. Average pressure per hour †	Rainfall.	Remarks.
Mean.	29·391	78·1 ‡	66·3 ‡	59·5 ‡	·576 ‡	·607 ‡	141 2	91 5	65·5	48 7	61 0	2·8	100·4	74	0·111	...	
Highest in year.	9th December 29·854	4th June 114·4	10th September 86·4	10th September 85·9	10th September 1·239	14th September ·979	165·1 §	4th June 114·4	10th June 87·5	29th March 58 9	8th June 83·1	5th February and 24th March 8·0	March 117·5	11th April 383	11th April 1·2	43.876	§ 17th April, 26th and 27th May; and 3rd and 21st June. ‖ 25, 26 and 30th April; 1, 11, 12, 25, 27 and 29th May; 1, 2 and 8th June; 22, 26 and 30th September; 2 and 20th October; and 20th December 1876.
Lowest year.	16 and 30th July 29·332	15th January 36·2	5th February 42·2	5th February 21·9	5th February ·112	12th May ·087	11th August 82 1	9th February 69·2	15th January 36·2	5th February 39·9	14th January 32·4	1·0 ‖	August 84·2	21st 24th & 25th December & 16th January.	19th October 0·0002.		

* For February and March 1876 only.
† From April to October 1875
‡ These means are only approximate for reasons stated in the report under their respective headings.
N. B—From the 6th November 1875, the observations have been taken on the new system in accordance with instructions issued by the Meteorologist to the Government of India, *viz.* daily at 10 A. M. and 4 P. M., and hourly on the 7th, 14th, 21st, and 28th of each month.

General retrospect of the Weather during the year 1875-76.

April. It was more or less cloudy on the 1st, 2nd, 3rd, 4th, 5th, 6th, 8th, 10th, 11th, 14th, 16th, 17th, 18th, 20th, 21st, and 22nd; hazy on the 7th and 23rd, and remaining days clear. The prevailing wind was W-N-W. High wind on the 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th 15th, 16th, 17th, 18th, 19th, 20th, 23rd, 26th, and 30th. Drizzle on the 5th. Lightning on the 2nd, 5th, 27th, 28th, and 29th. Dew on the 1st, 2nd, 5th, 6th, 13th, 14th, and 15th.

May. It was clear on the 6th, 7th, 12th, 13th, 14th, and 15th, and remaining days more or less cloudy. The prevailing wind was E-S-E. Storm on the 2nd from N-W., at 19·20 hours, with a maximum pressure of 1½lb. at 19-45 hours with lightning and thunder on the 18th from N-W., with very much dust, thunder, and few drops of rain at 15-30h, with a maximum pressure of 3lbs; and on the 24th from N-N-W. at 20-15h, with lightning and very much dust with a maximum pressure of 2lbs. High wind on the 1st, 2nd, 4th, 6th, 9th, 11th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 26th, and 31st. Drizzle on the 18th and 22nd. Lightning on the 6th, 7th, 8th, 9th, 10th, 16th, 19th, 20th, 22nd, 23rd, 24th, 27th, and 28th.

June. Sky clear on the 2nd and 6th; and remaining days cloudy. The prevailing wind was E-S-E. Storm on the 19th from N. at 15-30h. with much dust, with a maximum pressure of 1 lb. High wind on the 1st, 2nd. 5th, 7th, 8th, 14th, 15th, 23rd, and 30th. Dust on the 1st, 7th, 8th, and 14th. Rain on the 12th. Drizzle on the 10th, 15th, 24th, 25th, and 28th. Lightning throughout the month, excepting on the 1st, 2nd, 3rd, 6th, 7th, 11th, 15th, 16th, 17th, 19th, and 20th.

July. It was more or less cloudy throughout the month. The prevailing wind was E-S-E. High wind on the 1st, 5th, 6th, 7th, 16th, 17th, 19th, and 22nd. Dust on the 6th, 17th and 22nd. Rain on the 7th, 15th, 16th, 24th, 27th, 28th, 29th and 31st. Drizzle on the 4th. 7th, 8th, 9th, 10th, 11th, 14th, 15th, 25th, 27th, 29th, and 30th. Lightning throughout the month, excepting on the 16th and 18th.

August. It was more or less cloudy throughout the month. The prevailing wind was E. High wind on the 7th and 24th. Rain on the 1st, 2nd, 3rd, 4th, 5th, 7th, 13th, 15th, 16th, 17th, 20th, 21st, and 29th. Drizzle on the 5th, 6th, 7th, 11th, 12th, 14th, 15th, 16th, 17th, 18th, 19th, 22nd, and 29th. Lightning throughout the month, excepting on the 15th, 24th, 25th, 26th, 27th, 28th, and 31st. Dew on the 31st.

September. It was more or less cloudy throughout the month. The prevailing wind was E. High wind on the 8th, 9th, 10th, 18th, 19th, and 28th. Rain on the 5th, 6th, 7th, 10th, 11th, 16th, 18th, 19th, 20th, 21st, and 22nd. Drizzle on the 2nd, 7th, 8th, 9th, 10th, 14th, 15th, 18th, 19th, 20th, 25th, and 26th. Lightning throughout the month, excepting on the 16th, 17th, 18th, 27th, 28th, and 29th. Dew on the 1st, 2nd, 4th, 5th, 11th, 12th, 13th, 14th, 16th, 17th, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, and 30th.

It was more or less cloudy on the 2nd, 7th, 18th, 23rd, 24th, 25th, 26th, 27th, and 28th, and remaining days clear. The prevailing wind was W-N-W. High wind on the 4th, 5th, 8th, 9th, 10th, 30th, and 31st. Few drops of rain on the 23rd. Lightning on the 2nd and 6th. Dew throughout the month. October.

It was more or less cloudy on the 14th, 19th, 23rd, 25th. 26th, 27th, 28th, and 30th, and remaining days clear. The prevailing wind was W-N-W. High wind on the 28th and 30th. November.

It was more or less cloudy on the 1st, 2nd, 3rd, 4th, 6th, 7th, 9th, 10th, 11th, 14th, 15th, 20th, 21st, 23rd, 24th, and 26th, and remaining days clear. The prevailing wind was W-N-W. High wind on the 1st, 17th, 22nd, 26th, and 29th. Rain on the 2nd. December.

It was more or less cloudy on the 2nd, 3rd, 4th, 6th, 7th, 8th, 10th, 11th, 12th, 15th, 17th, and 20th; hazy on the 25th; and remaining days clear. The prevailing wind was W-N-W. High wind with dust on the 9th, 10th, 11th, 12th, 13tn, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, and 30th. Rain on the 2nd. January.

It was cloudy on the 15th and 27th, partially so on the 9th, 12th, 13th, 14th, 16th, 17th, 21st, and 22nd, and remaining days clear. The prevailing wind was W-N-W. High wind with dust on the 2nd 3rd, 4th, 5th, 6th, 7th, 9th, 10th, 11th, 12th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 23rd, 24th, 25th, 26th, 28th, and 29th. February.

Sky hazy on the 7th and 8th; and remaining days more or less cloudy. The prevailing wind was W-N-W. High wind on the 4th, 6th, 7th, 10th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 22nd, 23rd, 24th, 25th, and 29th. Dust on the 4th, 6th, 7th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 22nd, 23rd, 24th, 25th, and 29th. Rain and drizzle on the 9th. Lightning on the 9th and 12th. March.

E. BONAVIA, M.D.,

Superintendent, Department of Science, Oudh.

No. 2566.

FROM

THE OFFG. PERSONAL ASST. TO THE CHIEF COMMR., OUDH.

To

THE SUPERINTENDENT DEPARTMENT OF SCIENCE, OUDH, LUCKNOW.

Dated Lucknow, the 5th June 1876.

SIR,

GENERAL DEPARTMENT.

I AM directed to acknowledge the receipt of your very interesting report on the Horticultural Garden of Lucknow, for the year ending the 31st of March 1876.

Paras 3, 4, and 5.

2. The receipts were somewhat less than in the previous year, being Rs. 8,180-9-1 against Rs. 8,421-8-6, and the expenditure slightly increased. The falling off was in the following items :—

Lease of land,
Subscriptions,
Sale of seeds.

The steady yearly increase, however, in the sale of garden-produce is satisfactory.

Para 19.

3. Your attempt to cultivate the various kinds of eucalyptus has not generally been successful. The eucalyptus rostrata (red gum) only appears to thrive ; a special report on this plant was called for and submitted to the Government of India in September last.

Para. 23 (d.)

4. The result of your experiment in growing bakla, which you think may be grown advantageously for feeding horses and cattle, was also reported to the Government of India.

Appendix.

5. The report on the experimental cultivation of wheat, gram, barley, and peas, contained in the appendix to your report, is interesting. It is noteworthy that the highest produce was that by one irrigation every 28 days; there is a marked decrease in the amount of yield obtained by the more frequent waterings.

Ditto

6. The experimental cultivation of crops for the purpose of ascertaining the amount of manure necessary to give the best results has either not been very carefully carried out, or the value of manure has hitherto been very much over-estimated.

7. In Itaunja the manure seems to have had little beneficial effect, with the exception of the first plot, in which 32 maunds were used ; and in Gaddia the best effect was from the smallest quantity of manure, and it seems to have affected the yield of bhusā more than the yield of grain.

I have the honour to be,

Sir,

Your most obedient servant,

A. MURRAY,

Offg. Personal Asst. to the Chief Commr., Oudh.

PRINTED AT THE OUDH GOVERNMENT PRESS.

Report on the Horticultural Garden of Lucknow for the Year ending 31st March 1876.

Accounts.

1. The accounts of the Horticultural Garden are now kept with the Treasury as ordered by the Chief Commissioner of Oudh.

Budget.

2. A regular budget is made out every year of estimated receipts and disbursements.

The balance of Rs. 686-10-11 remaining at the end of 1874-75, was re-allotted in the budget for 1875-76, by sanction of the Chief Commissioner of Oudh.

Of the Government allowance of Rs. 2,640-0-0 only Rs. 2,500-14-7 were drawn.

There is no difference in the interest on Government Notes.

The receipts on lease of land is less than estimated, a portion remains to be realized in 1876-77.

The receipts from 1st and 2nd class subscribers are less than the estimate. These vary every year, as subscribers go on furlough, or change stations; and as they are not all punctual in paying their subscription, a portion has to be collected in the succeeding year.

The sale of plants is less by only Rs. 39-0-7, the prices of plants having been revised, and that of roses and some other plants reduced.

The sale of fruit is more by Rs. 5-8-0.

The sale of flowers is less by Rs. 7-11-9.

The sale of acclimatized seed is more by Rs. 205-15-1.

The sale of imported seeds is more by Rs. 198-7-6.

The sale of wood is less by Rs. 20-10-0.

The sale of unserviceable bullocks is more by Rs. 19-0-0.

The sale of catalogues is less by only one anna.

The receipts on account of carriage of plants and seeds is less than estimated for by Rs. 94-1-7.

The receipts on account of miscellaneous things is four annas more.

There is a receipt shown in the accounts for 1875-76, which was not included in the budget, *viz.*, that for the purchase of a pair of Cabul donkeys. The sum was a special grant made by the Chief Commissioner of Oudh, and the payment for them was made in 1874-75.

Total receipts.

3. The total receipts of the year, in addition to the balance remaining from the previous year, made an available sum of Rs. 8,867-4-0.

The net receipts for produce of the garden including plants, fruit, acclimatized seeds, &c., amounted to Rs. 3,059-0-9, which is Rs. 327-0-3 more than was realized for the same produce last year.

4. The total expenditure on all the items amounted to Rs. 8,549-12-8 which shows a saving of Rs. 317-7-4. Expenditure.

The statement of accounts gives further details.

5. The revenue from sale of produce of the garden is increasing every year. The fruit alone fetched in 1874-75 Rs. 429-5-6, in 1875-76 Rs. 830-8-0, and on the 30th March 1876, I sold the fruit for 1876-77 for Rs. 2,075-0-0, so that next year I hope to show a larger saving. Improvement of revenue.

6. The accounts with seedsmen &c. stand as under :— Accounts with seedsmen, &c.

MESSRS. LANDRETH AND SON, PHILADELPHIA.

Balance in favor of Landreth and Son for 1875	doll. 3-40
Remitted on account of seeds for 1876	£ 50-0

MESSRS. H. S. KING, & Co.

For garden appliances, books, &c., remitted in 1875-76 ...	£ 16-11-8

7. The subscribers to the Horticultural Garden during the past year were— Subscribers.

First class	22
Second class	10

8. The number of plants sold during the year were— Plants sold.

Ornamental plants of sorts	1,624
Rose plants	708
Fruit trees	728
Cuttings of sorts	744

9. The number of plants supplied gratis for public purposes were— Plants supplied gratis.

Ornamental plants of sorts	149
Cuttings of sorts	262
Fruit trees	14

10. Two batches of vegetable seeds were imported from Messrs Landreth and Son, an early, and a later one. I heard of only *one* complaint about their not germinating, but as this may have been the fault of the person who sowed them, there is no sufficient reason to doubt the goodness of the American seeds. The amount of waste of imported vegetable seeds, which takes place every year, is simply incredible. People without experience think they can cheat the seasons, and obtain a supply of European vegetables earlier than any body else by sowing their seed in the rains. And the following is what as a rule happens :— Imported seeds.

(*a*).—The seed is sown, and a shower of rain, with excess of moisture, kills the seed before it appears above ground. In this case the failure is often attributed to the seed being bad.

(*b*).—The seed is sown on some favorable day and it germinates, but a heavy pelting rain roots up the tiny plants, and they are carried off by the stream, or are found lying dead on the soil the day after.

(*c*).—The seeds germinate and all appear to get on favorably, when their young leaves are devoured by the insects that swarm in the rains, and the young plants are thus killed. The most that can be done by early sowing is the raising of some cauliflower or cabbage, if raised ground be selected, plenty of seed be wasted, and a great deal of trouble taken with the young plants, in catching and destroying the green grass-hoppers which eat them up.

For this purpose plants raised from acclimatized seed have always the best chance of surviving. Very little can be done with other seeds before the rains stop.

Acclimatized seed.

11. There was a large sale of acclimatized seed in the past year also. The Lucknow Horticultural Garden is now famed for the following acclimatized seed, *viz.* :—

A good variety of early cauliflower.—Imported cauliflower seed rarely answers in Bengal and Southern India, while the Lucknow acclimatized cauliflower does. This year was very favorable for raising cauliflower seed. The prevalence of westerly wind, during the flowering and seeding time, prevented insects, such as aphides, from injuring the crop, and thus a quantity of seed of unsurpassed quality has been collected.

Three good varieties of tomatos.—One a giant kind, and two other useful varieties. Of the first, one single tomato weighed one seer.

An excellent kind of Cos lettuce.—This heads perfectly, is tender and sweet, and becomes fit for the table earlier than that from imported seed.

A very good kind of white onion.

With regard to acclimatized flower seeds, I have a large number of good kinds, but the most prominent are sweet peas, hybrid petunias and pinks. Strange to say, imported seed of sweet peas does not flower in Bengal and Southern India, while pea seed acclimatized first in Lucknow, does flower in those climates.

Progress of European vegetable among native.

12. In 1874, I gave some tomato seed to a native cultivator in '*Muriaon.*' He made a good profit by selling the produce to the European soldiers. In 1875 several other cultivators, seeing the profit their friend had made in the previous year, sowed between them about 4 *bighas* of tomatos; so that this vegetable became a drug in the market, and realized little profit. Unfortunately too, during last winter, some of the European regiments were away at Delhi.

Vines.

13. The old vinery has made good progress. The vines have grown well. At the close of the year there were 98 trees in fruit. A new variety has flowered for the first time. There is one kind, which is a seedling grown from seed I sent from Malta when on furlough. I do not know the name of it, but last year it produced a few small bunches. The ordinary grapes hitherto tried burst and rot, when the rain begins

to fall, by absorbing too much moisture. The grapes of this seedling were not injured by excess of moisture, the skin of the fruit appearing thicker than the ordinary kinds. At the close of the year, this seedling vine was covered with blossom, and I hope now to test further its value, in resisting the injurious action of moisture. Mr. Ridley has commenced a vinery on the new plan, namely that of training the plants on trees planted for the purpose. But it will take some years before any show is made. I feel certain that among all the varieties of vines to be found in many countries, there must be some which would suit this climate. The only way of solving this problem is to try as many kinds as possible, and propagate only those which are good and suitable to this part of India. This requires more time and patience than many are aware of. The plants have to be procured; then nursed and nourished for some years, and coaxed into showing what kind of fruit they are capable of producing; then it may be found that they fruit only in alternate years; so that even after they begin to fruit, some more years must elapse before one can definitively decide whether a particular kind is useful or worthless. Some trees bear very indifferent fruit while young, and improve very much when they have ripened their wood, and come to an adult age. So that it is not wise to discard a plant, until it has been thoroughly tried.

Leechis.

14. The leechi trees in the garden are all young, and they make slow growth; 17 of them were in flower for the first time at the close of the year.

Oranges, lemons and pummelows.

15. I have ascertained from observations carried on over a series of years, that the value of the kinds of oranges we have is according to the following order. The uppermost being the best :—

1. Mandarine.
2. Sylhet.
3. Nagpore.
4. "Paenbagh."
5. Malta.

They are all productive, but the goodness of their flavor, in my opinion, is as indicated by the above order. The *Mandarine* orange is the most delicate of all, but the tree is tender and is liable to injury by hot winds. Perhaps it would do better in a soil less sandy than ours. The *Sylhet* is a fine flavored orange; the tree grows upright, without much spreading, and is hardy even when ordinary care is given to it. Of the *Nagpore* kind, I originally procured two distinct varieties. One has succeeded admirably, is fine flavored, and very productive. The fruit is rather pointed towards the stem. The other kind has proved worthless; it produces very little, and the little it bears is shrivelled and small. It is a question whether it is worth keeping. The "*Paenbagh*" is a large kind and resembles the Malta variety in flavor. It is very productive. The *Malta* orange, although productive, has not retained the flavor of the fruit of its country. The blood variety has lost its peculiarity of color by importation, and

only a faint streak of red is to be seen now and then. Besides the kinds above noted, we have the *Cintra* orange. This kind, although it thrives admirably about Delhi, does not do so here. Very few of the fruit on each tree come to perfection, and some of the trees have got diseased and have died. This kind with one of the Nagpores will probably have to be discarded. Most of the orange and lemon trees last year produced, for the first time, a second crop which natives call "dumrez." In Europe, the lemon invariably does so, but I did not know that the orange did so likewise. The flavor of the dumrez orange is better than that of the principal crop. The number of trees in fruit at the close of the year was :—

Oranges of sorts ...		...	1,334
Lemons	...	...	106
Pummelows	...	...	136

Mangos

16. It was a sight to see the profusion of blossom on the mango trees in March last. There are now 476 trees in fruit-bearing condition, and the majority are healthy, vigorous, young trees, averaging from 6 feet to 20 feet high. At first these trees grew slowly on account of the poor soil, and because a sufficiency of manure could not be annually spared for such a large number of trees; but now, having made a certain growth, every year the shedding of the leaves creates a layer of mould which serves to nourish the trees. It is true that this sort of manure comes from the trees themselves, but they do not obtain it *all* from the soil, as water and air contribute towards the production of leaves, so that what is not obtained from the soil is so much gain to the tree in the shape of additional leaf mould.

Natives are in the habit of selling the fallen leaves of their 'baghs' to the grain-parchers. But this is the greatest mistake that can be committed in a horticultural point of view. It has been ascertained in Europe that when old trees are commencing to decay from exhaustion of the soil, they can be renovated by a good layer of leaves round their stem, which by decaying, afford new nourishment to the trees. I have scrupulously prohibited any of the fallen leaves to be removed. The advantage of this rule is apparent. A time in the growth of these trees will come when no other manure will be requisite, than that furnished by their fallen leaves. In my opinion, no more appropriate manure can be given to any plant than that produced by its own decayed leaves. Of course when plants are young, they require to be aided by some foreign manure to enable them to obtain a certain growth. At the close of the year there were 310 mango trees in fruit.

Some years ago, I sowed some seeds of good kinds of mangos. Last year, several of these fruited, and a proportion of them produced new varieties of mangos, of good size and flavor, which will be very useful for propagation. This year, I sowed a large number of seeds of various excellent kinds. Many of them have been planted out, and I hope in course of time to get new varieties out of many of them. This year also, the Deputy Commissioner of Lucknow kindly allowed me to take some grafts from a mango tree called "surkha," an excellent variety and the only one in

Lucknow. It is in "Moonaur-ud-Dowlah-ká-Bagh." The best of these grafts have been planted out, and will form a valuable addition to our collection. Not only is the flavor of this kind excellent, but it is very beautiful to look at. It is of a rich yellow color, with a dash of carmine on some parts of it. Natives say it cannot be propagated by seed, because it is "bedana" (without kernel). And in fact the stones are as thin as a rupee, but out of several attempts, I managed to get three seeds to germinate, which may give useful varieties. Unfortunately its "bedana" peculiarity can only be propagated by grafting.

Loquats.

17. I originally procured some trees of the loquat from various parts. One set turned out a very good variety. Its fruit is oblong, of a pale yellow, of good flavor and larger than the ordinary kind. It has moreover the good quality of having only one seed, or at most two. The ordinary kinds are small, and each fruit has four or five seeds, so that one is disappointed in finding more seed than pulp. The abovementioned variety has opposite qualities, *viz.*, more pulp than seed. There are only 4 trees of this good kind, but now that I have ascertained beyond doubt that we possess a kind of loquat worth propagating, there will be no difficulty in multiplying it rapidly. Like mangos, the loquat is propagated by grafting.

Arabian date palms.

18. Of the last batch of imported date palm sprouts, only a comparatively small number struck. Out of 100 sprouts only 35 struck. They arrived at a favorable season, were planted in a shady nursery, and treated in every way as the previous ones. I should say that the reason of so many failing was due to the sprouts not having been sufficiently matured, before being separated from their parents. They should always have a good portion of matured wood to support them until they strike. The old sprouts which have now been planted out some years, are in a very thriving condition and have thrown a number of sprouts at the base of their stems. However, I do not dare to separate the sprouts until they are a good deal riper. We have now in all planted out—

Seedlings	383
Old sprouts	77
Young sprouts newly planted out	35

Eucalyptus.

19. Of the various kinds of Eucalyptus sown last year only the following are now alive :—

Eucalyptus globulus (*blue gum*).—46 plants; but not more than a dozen are thriving with any vigour. Of this now famous eucalyptus, which was said to suck up swamps and destroy malaria, I had hundreds of plants before last rains, but as soon as they felt the atmosphere of the rains, they died away by scores. I fear that those which are now alive and flourishing, although they have survived the last rains, may die, as others have done before, in some unusually rainy season. I do not think this kind at all suited to the plains. Excess of moisture at its roots, and a moist and hot atmosphere appear to be fatal to it.

Eucalyptus calophyllata.—Of this, I have 10 plants alive, and all appear sickly. Numbers of young ones died off in the rains.

Eucalyptus (species). (Shingly bark gum).—All died.

Eucalyptus collossus. (Kani gum).—Of this, five are alive, and appear to be flourishing and growing rapidly. Numbers of young plants also died off in the rains.

Eucalyptus obliqua.—Of this none are alive.

Eucalyptus amygdalina.—All died.

Eucalyptus marginata.—Only two are alive; all the rest died in the rains.

Eucalyptus (species). (Weeping gum).—All died.

Eucalyptus fissilis. (Swamp gum).—Of this, only 3 are alive.

Eucalyptus gonicalyx.—Of this species, 20 plants are alive. Most of them are in fair condition, and some appear to be doing well, so far. This is a slender tree, with a slender leaf.

Eucalyptus rostrata. (Red gum).—Of this kind I have 425 plants, most of which are in a flourishing condition. This is the only kind, which, I think, can be introduced into the plains of India on a large scale. The young plants were put into a nursery, and then transplanted again during the rains to a plot of ground, consisting of rather rough soil, that is sweepings about two years old, which had never been turned. Nevertheless the plants flourished, and many of them are now 8 or 10 feet high and growing rapidly. Upon the whole they have been subjected to rather rough treatment, and have passed through it without any injury. This kind bears transplanting well, and I think is the one to try to cultivate extensively throughout the plains, all the other kinds I have tried are, in my opinion, unsuited for general cultivation, although a few may thrive under exceptional circumstances. All the species above-named I had principally received from Mr. Cresswell, seed merchant in Melbourne; some from Dr. King of the Royal Botanical Garden; and some from Major Birney, through Dr. Sutherland. I have some doubt respecting their having received proper Botanical names in all instances. I have however lately received seeds of the following kinds from Baron Mueller, the Government Botanist in Melbourne. There is every reason therefore to suppose that these are accurately named, as Baron Mueller is perhaps the only person, who has made a thorough study of the Eucalypti. The kinds received from him are—

Eucalyptus globulus.

Eucalyptus fissilis (swamp gum).

Eucalyptus cornuta.

Eucalyptus obliqua.

Eucalyptus marginata (yarra).

Eucalyptus sideroxylon (iron bark).

I also received a large supply of Eucalyptus Rostrata, and a small packet of Eucalyptus Marginata from Mr. Cresswell, as I wish to try and settle definitively whether it is the *Rostrata* which is the species adapted to our climate. With this view, I have sent a packet of it to each Deputy Commissioner in Oudh for trial, with printed instructions for sowing, transplanting, &c., and I have distributed more to other persons in various parts. The seed lately received, both from Baron Mueller, and Mr. Cresswell, has all germinated, and will receive careful attention. With regard to Eucalyptus Rostrata, Baron Mueller says :—

"The species which you praise is probably Eucalyptus Rostrata as you surmise. It is the only one which extends from the South to the North coast, and from the West to the East coast of Australia, and it likes water, so that in swampy localities it is one of the best, and stands more humidity, combined with heat than most species. It moreover grows faster than Eucalyptus Marginata, while its wood is alike imperishable."

20. I have succeeded in collecting the following kinds of bamboos, which have been planted out, and are flourishing :— **Bamboos.**

Bambusa arundinacea (katang).
Do. vulgaris (Thouarsii).
Do. Fortuniana.
Do. tulda.
Do. balcooa.
Do. gigantea.
Do. nana.
Do. (species.)
Dendrocalamus strictus (bambusa stricta).

These are all useful kinds, but some of them can be propagated much more easily than others.

21. Of the plants received, and also raised from seed lately procured from various places, the following have survived, and are so far doing well :— **New plants.**

Paulonia imperialis.
Schinus molle.
Cœsalpinia coriacea.
Cananga odorata.
Ravenala Madegascariensis.
Rhus rhodanthera.
Thuja orientalis (var-chinensis.)
Callistris cupressiformis.
Pinus longifolia.
Marlea begoniœfolia.
Caryota urens.
Livistona mauritiana.
Seaforthia elegans.
Licuala spinosa.
Chamerops Fortuniana.
Euterpe (species).
Arenga saccharifera.
Demonorops Luisianus.
Calamus (species) (from the Andamans).
Cannas of various kinds.
Coleus of various kinds.
Grevillea robusta.
Encephalartos Miquelii.
Cycas circinalis.
Millettia megasperma.

Coffea arabica.	Icica bengalensis.
Three kinds of Brownea.	Passiflora edulis.
Jonesia asoca.	Stephania rotundifolia
Schizolobinun excelsum.	Clerodendron Thomsonii.
Hodgsonia heteroclita.	Acacia melanoxylon.
Yucca reflexa.	Acacia (species).
Tristania conferta.	Cineraria marittima.

The following ornamental plants have been purchased, and so far are doing well :—

Begonias.	Clematis.
Gloxinias.	Dahlias.
Achimenes.	Caladiums.
Tydœas.	Gladiolus.

Frost

22. Scarcely a leaf was touched by frost during last winter. The minimum temperature, indicated by the terrestrial radiation thermometer, was only 32·4 on the 14th January. It was a very mild season indeed. Usually tomatos and nasturtiums are the first to feel the night cold; this year they were not touched.

Experiments

Sugarcane

23. (*a*).—In 1873-74, one field (15 biswas and 18 biswansis in extent) produced as its first crop 518 maunds of sugarcane, of the common country kind. The field was not specially manured, but the crop fed on what manure was left from previous crops. It was irrigated 12 times. In 1874-75, the old roots were allowed to shoot up again on this same plot. No additional manure was given, and the ground was irrigated 15 times. The produce was 216 maunds of sugarcane. This showed that the soil was exhausted, and would give a smaller and smaller amount from the same roots, year after year, *without* additional manure.

In 1875-76, I allowed the same roots to remain on this plot, but gave the ground a top dressing of 60 cart loads of wood ashes, and hoed them in among the roots. The ground was irrigated 13 times. The produce was 454 maunds of sugarcane. This, I think, is sufficient to prove the great value of wood ashes. The produce, with the addition of them *alone*, was more than doubled.

Cuzco maize

(*b*).—30 lbs. of Cuzco maize were received on the 8th February 1875, from the Secretary to the Government of India. It was carefully kept till the usual season for sowing maize came.

It was sown on the 9th July, immediately after the rains commenced, the soil having been well ploughed and cleaned. The previous winter crop was French honeysuckle, Hedysarum coronarium, and the ground for this was manured with stable litter. No manure was put in for the Cuzco maize.

The Cuzco maize did not all germinate, but only about two-thirds of it.

. Of those that germinated, some perished while young from weakness; the remaining plants, 2,854 in all, grew well and thrived. The majority of them reached a height of ten feet. They appeared very healthy and promised well, but not having any support, from so few having germinated, and on account of their tallness, they were easily blown down by the wind; so that many of them had to be supported by, and tied to sticks. Many of them gave numerous roots from the lower joints.

The male flowers appeared about the 26th of September. The female flowers coming later. Some plants produced one, some two cobs, and some gave three or more branched cobs from the same joint. Some of these cobs had their seeds entirely unfertilized; some had only a few seeds fertilized, and were apparently doing well; others, although they had some fertilized seeds, rotted before they came to maturity. The seeds of others began to germinate on the cob before they were ripe; and finally, only, a small proportion of cobs showed any promise of safely bringing their few scattered seeds to maturity.

On the 1st of December some of the cobs which were tried were found to have their seeds ripe, and so all the plants were cut and stacked, to fully ripen whatever seed was on them before the cobs were plucked.

The result of this experiment is 90 cobs, containing about 1,000 ripe seeds, but none of the seeds, in any way, came up to the standard of size of the original seed.

The seed will be kept for further experiment, but I may say that, on the whole, I do not think that the Cuzco maize is suited to the plains of India. As it comes from the dry and cold regions of the Andes in Peru, it may be more suited to the regions beyond the influence of the rains in the Himalayas, such as Chini, Pangay, and other valleys among the snowy peaks. The climates of Cuzco, and the plains of India are too dissimilar for any prospect of success or competition with the native Indian corn, which has been selected for generations, and has had thus ample time to adapt itself, not only to the climate, but also to the mode of cultivation practiced by the natives of India.

I have seen cobs of *native* Indian corn nearly a foot long, and beautifully furnished from top to bottom with a uniform, and most complete series of grains. It is true the grains were small, but the total weight of grains on each cob must have far exceeded the weight of all the large grains on a cob of Cuzco maize, even if every grain of the latter had been fertilized, and had gained the size of the original seed.

Although, in my opinion, the Cuzco maize is unsuited to the climate of the plains, it may nevertheless be successfully grown in the cold regions of the Himalayas, and perhaps become a valuable addition to the scanty productions of the snowy ranges.

In order to try whether the winter might not suit the Cuzco maize better than the rains, I kept back a handful of seeds, and sowed them, 29 in number, on the 10th of October, after the rains had ceased, but none of them germinated.

Sorgho, jowar and bajra.

(c).—Immediately after the first showers of last rains fell, three plots of ground were selected, and well ploughed and cleaned. On the 9th July 1875, one was sown with sorgho, the second with native "jowar," and the third with "bajra." The cultivation of all three was conducted in the ordinary native fashion. The previous winter crops were sugar beet, manured with stable litter, on the "sorgho" field; annuals, manured with wood ashes and stable litter on the "jowar" field; and country carrots, manured with wood ashes on the "bajra" field. No fresh manure was put in for the crops under experiment. They all germinated well; the fields were weeded once, between the 4th and 11th August; and the plants were thinned here and there, when necessary, during the weeding. All three crops grew very luxuriantly.

(1).—The amount of ground used for the sorgho was 1,395 square yards. The crop showed signs of flowering in the beginning of September, and at this period, the canes were sweet. On the 26th of September, it was in full seed. The tallest plants were 6½ feet high, and the thickest of them measured 2½ inches in girth, two feet above the ground.

140 square yards of this crop were cut for green fodder on the 3rd October. Its weight was 8 maunds.

The remaining portion, 1,255 square yards, was left for seed and dry fodder. It was cut when the seed was fully ripe on the 30th November. The ripe and dry seed weighed 4 maunds 5 seers; and the 'karbi' when dry weighed 25 maunds.

(2).—The amount of ground used for the native "jowar" was 1,740 square yards. The crop showed signs of flowering about the 5th October. The average height of the tallest was 12 feet. The whole field looked infinitely finer than that sown with sorgho. The canes were thicker, but had no trace of sweetness in them. The tallest and thickest were 2¾ inches in girth, two feet from the ground; 168 square yards of this plot were cut for green fodder on the 5th October. It weighed 18 maunds and 5 seers.

The remaining portion 1,572 square yards was left for seed and dry fodder. The seed was ripe on the 20th November. The crop was cut on the 1st December. When ripe and dry, the seed weighed 5 maunds and 3½ seers. The dry 'karbi' weighed 50 maunds.

(3).—The amount of ground used for the "bajra" was 1,895⅔ square yards. The crop was growing very luxuriantly, and had attained an average height of 5 feet, when a prolonged heavy fall of rain, with strong wind occurred, on the 13th August 1875, and the whole "bajra" crop was blown down level with the ground. Trying to raise it again, being hopeless, it was cut for green fodder a few days after. The stubble did not make a successful second growth.

The rains this year in Lucknow were unusually late in commencing, the first showers not having fallen till the 25th June. And the total fall was 42·8 inches. The last showers fell on the 22nd September.

Neither the sorgho after the cutting for green fodder on the 3rd October, nor the "jowar" on the 5th October, made any successful growth as a second crop.

After having given careful attention to the experiments made with sorgho both during the last 3 or 4 years, and also in 1861 and 1862, I have no hesitation in stating that, whatever this crop may do in Southern India, where the climate is warmer and damper, in Lucknow, at least on soil such as we have in the Horticultural Garden, it has never produced a satisfactory second crop after the first cutting for green fodder.

In addition, I do not think there can be any doubt, which kind is most suited for Upper India, the *Chinese* "jowar" (sorgho), or the *Native* "jowar."

I have never under any circumstances, succeeded in growing sorgho, more than 7 feet high or so. While "jowar," under similar conditions, will grow to 12 feet.

And looking at the two crops side by side, the difference in favor of the jowar is surprising. It is true the sorgho is sweet, but the extra sweetness can hardly counterbalance 'cœteris paribus' the great difference of extra weight in "karbi" of the "jowar."

If sorgho were sown in the hot weather, before the rain fell, it would, in my opinion, require a great deal of irrigation to give more than one good crop for green fodder, and the manure must be very liberal indeed. If it be sown at the commencement of the rains, and cut when three or four feet high, it may have time to give a second inferior crop of about the same height, when it will seed and grow no higher.

As to seed, the sorgho flowers early, that is at the end of August, or beginning of September, according as the commencement of the rains is early or late, the sowing being made at the commencement of the rains. August being usually the height of the rains, the sorgho pollen runs every risk of being washed off by heavy showers, before it could take effect. Many of the seeds would therefore remain unfertilized, as happened in the previous years' experiment. The country "jowar," on the contrary, begins to flower after the rains are over, and during bright warm weather. Every seed therefore is almost sure to be fertilized. Under these circumstances, in my opinion, sorgho has no chance of competing with the native "jowar," as the yield of karbi from the latter is much greater, and the seed-yield of sorgho is precarious.

I may mention that natives have in course of generations selected two varieties of "jowar;" the one short, producing large ears; the other tall, producing small ears. The former is sown for the grain, the latter for the 'karbi.'

It appears these two varieties are complementary; what is gained by the seed in the one, is gained by the "karbi" in the other.

The kind of "jowar" I experimented with was that which natives sow for 'karbi,' and even in that, the amount of seed yielded was equal to

that given by the sorgho, which this year seeded very well, having flowered in the intervals between heavy showers. Had the kind of "jowar" been sown which natives use for seed, I am sure the yield would have been much larger than that of the sorgho. The accompanying statement gives the result of this experiment in a tabulated form :—

Experiments with Sorgho, "Jowar," and "Bajra," performed during the rains of 1875, in Lucknow.

Name of crop	Date of sowing	Quantity of seed sown per acre.	Number of acres sown.	Mode of cultivation adopted.	Date of cutting for green fodder.	Date of cutting for seed and karbi.	The yield in weight per acre. (a) Seed. (b) Fodder.	Remarks.
Sorgho ...	9th July .	10 lbs. ...	A. R. P. 0 1 6	The usual native mode in all three plots. Immediately after the first showers fell, the ground was well ploughed and cleaned.	After seeding on 3rd October. Yield per acre. Mds. S. 276 23	30th November 1875.	Mds. S. C. (a) 15 36 5 (b) 96 16 9	
Jowar ...	9th July ..	11 lbs. .	A. R. P. 0 1 17		Immediately before flowering on 5th October. Yield per acre. Mds. S. C. 522 6 14	1st December 1875.	Mds. S. C. (a) 15 26 8 (b) 153 36 11	
Bajra .	9th July ...	5 lbs. ...	A. R. P. 0 1 22		Between 24th August and 14th September. Yield when 4 or 5 feet high per acre. Mds. S. C. 679 5 15	(Blown down by the wind).		

Horse bean.

(*d*).—There is a native horse bean, little known, which natives call "bakla", and which is never grown as a crop. It is a small black bean about the size of large gram, and therefore much smaller than the horse bean of Europe. It is very prolific, the branches being covered with pods from the base to the top of the stem. Each seed was sown one foot apart, and each plant gave such a number of branches, that the plot was completely filled and appeared too crowded. It grew to the height of 2½ feet. 502½ square yards of ground, or 3 biswas and 1 biswansi, gave 4 maunds and 25 seers of beans, or at the rate of 30 maunds, 13 seers per bigha. I am informed that gram on good soil will only produce 10 or 12 maunds per bigha. It would therefore, I think, be advantageous to grow this bean on a large scale for feeding horses and cattle as in Europe. Its yield is about three times that of gram, and ought to be profitable to grow. The quantity required for seed is nominal, as at one foot apart the plants were too crowded. On better soil than we have in the Horticultural Garden, which is sandy, the yield might be even greater than above stated. Of course it requires more irrigation than gram.

(*e*).—Of this white carrot I sowed a field for cattle fodder. The seed germinated well and the crop grew luxuriantly, producing fine roots. 1,309⅔ square yards of ground, or 8 biswas and 13 biswansis, gave 186½ maunds of carrot, including leaves and roots. Belgian carrots.

(*f*).—I have been making for the last few years small experiments with two kinds of new oats, *viz.*, "Provence" and "Coulommiers," and also with a kind of Australian wheat, originally procured from the Superintendent of the Taj Garden. I think they will prove useful, but further experiments are required to ascertain their value. Oats and wheat.

24. The mare was in foal when purchased. She foaled in June. The young one appears to be a strong healthy animal. The mother is in foal again. Cabul donkeys.

25. 2,068 running feet of pucca water channels have been made. In the hot weather, especially when the wells are worked night and day, the pucca water channels are of great value. Not only a large extent of ground, when most requiring it, can be irrigated from one well, but much time is saved, and therefore the same ground can be re-watered within a shorter period. As these channels are completed, the water of one well can be utilized much more efficiently than before. Water channels

26. Five pairs of fine young bullocks have been purchased from the Bahraich district, through the kind aid of Colonel Steel. Bullocks

27. 2,083 running feet of road averaging 5½ feet wide have been metalled, and four sets of steps with their railings leading from the upper to the lower level have been renewed. Roads.

28. The annual horticultural show was held on the 10th March. The accounts of the show stand as under :— Horticultural show.

Remaining from last year	Rs.	293	3	8
Contributed by European and native gentlemen	„	139	0	0
Contribution by municipality of Lucknow ...	„	50	0	0
Sale of tickets	„	72	12	0
Total ...		554	15	8

The expenses were as follows :—

Distributed in prizes	Rs.	161	0	0
Carriage of tables, chairs and other miscellaneous expenses	„	28	10	0
Printing hand bills and tickets	„	14	4	0
Making eight tables for the show	„	43	8	0
Balance remaining ...	„	307	9	8
Total ...		554	15	8

The show on the whole was an improvement on that of the past year. The contributions of fruit and strawberries were much better than usual. There was a greater display of ferns, plants with ornamental foliage, and

flowering plants. The cut flowers were rather injured by the heavy rain of the previous night. The vegetables were good, but for some, the season was rather advanced, although cauliflower was better represented than usual, so late in the season. The committee for awarding prizes consisted of Colonel Smith, Major Wilkinson, Captain Le Grice, Captain Crosthwaite and Mr. Hoskins.

Seeds and plants received.

29. The following plants and seeds were received during the past year :—

ROYAL BOTANICAL GARDEN, CALCUTTA.

Seeds of Dyospyros ebenus.
„ Grevillea robusta.
Corypha elata.
Cycas spherica.
„ Rumphii.
Pandanus furcatus.

AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA.

Araucaria Cunninghamii.

GOVERNMENT GARDEN, HONG KONG.

Pinus chinensis.
And a bundle of various other kinds of seeds

BRITISH LEGATION, YEDO.

A bundle of Japanese seeds.

CONSERVATOR OF FORESTS, OUDH.

Dalbergia latifolia.
Conocarpus latifolia.
And some plants of Wallichia disticha.

ACCLIMATIZATION SOCIETY OF QUEENSLAND.

Eucephalartos Miquelii.
Millettia negasperma.
Tabernœmontana orientalis.

COLLECTOR OF BELLARI.

Poinciana elata.
Acacia planifrons.

BOTANICAL GARDEN, SAHARUNPORE.

Seeds of various coniferœ.

HORTICULTURAL SOCIETY OF MYSORE.

Two packets of seeds.
A packet of various sorts of achimenes and tydea roots.

DR. SUTHERLAND.

Seeds of dahlia and of the wild Himalayan rose.

CAPTAIN PITCHER.

Seeds of the Peccan nut from Texas.

BARON MUELLER, MELBOURNE.

Various kinds of Eucalyptus seeds.

B. STAINFORTH, ESQUIRE.

Bulbs of anamotheca (species), and plants of cineraria marittima.

MODEL FARM, CAWNPORE.

Plants of six kinds of vines.

30. The following are the various places to which plants, &c., have been sent in 1875-76 :— Places to which plants have been sent.

Allahabad, Agra, Azimgurh, Balrámpur, Barout, Bijnour, Bareilly, Calcutta, Chupra, Darjeeling, Futtehpur, Fureedpur, Gorakhpur, Hutwa, Jubbulpur, Jeypur, Jhansi, Lullitpur, Moradabad, Mían Mir, Meerut, Muttra, Nynee Tal, Ranikhet, Simla, Shahjehanpur, Saugur and Umballa, and also to various places in the Oudh Province.

31. To all Deputy Commissioners in Oudh. Seeds distributed gratis.

1 Seer Sorgho.
5 Chittacks Australian wheat.
12 Do. country flax.
1 Seer Horse bean.
1 Packet "Bara" rice.
1 Do. "Munro" Tobacco.
1 Do. Manilla Tobacco.
1 Do. Ornamental Palm seed.
1 Do. Eucalyptus rostrata.
1 Do. Bignonia Adenophylla.
1 Do. Sterculia Colorata.
1 Seer Pithecolobium dulce (Inga dulcis).

Abstract of the Horticultural Garden Accounts for 1875-76, *commencing from* 1*st April* 1875 *to* 31*st March* 1876.

Number.	Actual Receipts.	Amount.	Total.
		Rs. As. P.	Rs. As. P.
	Balance on 1st March 1875,...	...	686 10 11
1	Government allowance for 12 months	2,500 14 7	
2	Interest on Government Notes for 1 year	108 0 0	
3	Lease of land	309 10 10	
4	Subscription 1st class	432 0 0	
5	Ditto 2nd class	72 0 0	
6	Sale of plants	1,560 15 5	
7	Do. of fruits	830 8 0	
8	Do. of flowers	142 4 3	
9	Do. of acclimatized seeds	505 15 1	
10	Do. of wood	19 6 0	
11	Do. of imported seeds	1,198 7 6	
12	Do. of old and unserviceable bullocks	44 0 0	
13	Do. of catalogue of plants	14 15 0	
14	Receipts on account of carriage of plants and seeds sent out	205 14 5	
15	Miscellaneous	50 4 0	
16	Receipts on account of purchasing a pair of Cabul donkeys from Amritsar	185 6 0	
			8,180 9 1
	Total Rupees	...	8,867 4 0

Number.	Disbursements.	Amount	Total.
		Rs. As. P.	Rs. As. P.
1	Messrs D. Landreth and Son for imported seeds	500 0 0	
2	Freight on imported seed	129 12 4	
3	Landing charges of imported seed and plants	80 0 0	
4	Salary of Mr. Ridley from March 1875 to February 1876	600 0 0	
5	Pay of Permanent Establishment from March 1875 to February 1876	1,868 11 7	
6	Pay of Temporary Establishment from March 1875 to 29th March 1876	799 13 2	
7	Food of bullocks	902 12 1	
8	Completion of new well	299 14 1	
9	Carriage of plants and seeds despatched and received	371 4 5	
10	Construction of plant house and repairs	199 3 6	
11	Trellis work...	49 13 6	
12	Purchase of plants	149 12 6	
13	Do. earthenpots	150 0 0	
14	Do. manure...	299 7 7	
15	Do. implements and leather buckets	249 15 4	
16	Do. bullocks	300 0 0	
17	Do. books	100 0 0	
18	Refund to purchasers on account advances	30 1 0	
19	Construction of water channels and repairs	350 0 0	
20	Printing and advertizing	60 0 0	
21	Postage Stamps &c.	59 10 0	
22	Stationery	49 12 0	
23	Repairs to carts	196 14 1	
24	Making and repairing roads ...	399 4 8	
25	Repairs to potting shed	50 0 0	
26	Contingent expenses	303 10 11	8,549 12 8
	Balance in Treasury ...	...	317 7 4
	Total Rupees ...	...	8,867 4 0

LUCKNOW:
The 15th April 1876.

E. BONAVIA, M. D.,
Supdt., Dept. of Science in Oudh.

APPENDIX.

1. I think the following agricultural experiments are sufficiently interesting to be recorded as an appendix to this report. They afford some data for further experiments.

2. In the winter of 1872-73, Mr. Boys, Superintendent Encumbered Estates of Sitapur, made some experiments with a view of ascertaining the number of irrigations necessary to obtain the maximum of produce, other things being equal.

3. Four pucca bighas of land of "doomat sundri" (a loam of slightly reddish tinge) were taken. Each bigha was divided into four equal parts. One bigha was sown with wheat, another with barley, a third with gram, and a fourth with peas.

4. ¼th of every bigha was irrigated every 7th day; ¼th every 14th day; and ¼th every 28th day; the last ¼th was left entirely unirrigated.

5. The difference in irrigation did not appear to affect the quality of the grain, but the quantity of the produce was affected in a very marked manner. The most satisfactory produce was that by one irrigation every 28 days, or every moon. In all cases, the amount of grain, by irrigation once in a moon, was nearly double, or more than double that by irrigation, once every week. The amount of straw in the case of wheat and gram was also increased, by diminishing the number of irrigations, not so markedly, however. In the case of barley, and in the case of peas, the reverse occurred. The least satisfactory produce of all was from those plots which received no water at all. They all gave less straw and grain than any, with the exception of barley. In this case, without water, the amount of barley grain produced was slightly more than by watering every week.

6. With regard to gram, natives have a notion that better results are obtained by not irrigating it, but this experiment disproves this notion. Irrigating it once a moon, quadrupled the amount of grain, resulting from the treatment by no irrigation.

7. The results are herewith given in a tabulated form, with further details.

Experimental cultivation of wheat, gram, barley and peas in Katesur illaqua, district Sitapur, during the winter season of 1872-73.

	Each plot was the ¼ part of a pucca bigha.	Native name of soil used.	How often irrigated, date of first irrigation.	Number of times weeded.	Total weight of straw (dry).		Total weight of grain after thrashing		Weight of a cubic foot of the resulting grains in lbs., oz., &c.		Remarks
	ILLAQUA KATESUR.		Dec 19th 1872. Times.		lbs.	oz.	lbs.	oz.	lbs.	oz.	
Wheat.	Plot No. 1, Irrigated every 7 days ...	"Doomat sundri" a loam of slightly reddish tinge.	15	All plots weeded once.	69	8	64	4	51	0	
	" " 2, " 14 " ..		7		109	10	81	14	51	3	
	" " 3, " 28 " ...		4		140	12	111	10	51	5	
	" " 4, Unirrigated		*Nil.*		25	10	27	14	51	5	
Barley.	Plot No. 1, Irrigated every 7 days ...		15		20	14	32	14	45	0	
	" " 2, " 14 " ...		7		87	2	78	12	45	3	
	" " 3, " 28 " ...		4		76	3	107	6	45	5	
	" " 4, Unirrigated		*Nil.*		13	12	40	0	45	13	
Gram.	Plot No. 1, Irrigated every 7 days ...		15		28	13	31	14	50	0	
	" " 2, " 14 " ...		7		*18	7	65	12	50	2	* This is doubtful.
	" " 3, " 28 " ...		4		34	13	77	10	50	5	
	" " 4, Unirrigated		*Nil.*		19	0	18	6	50	10	
Peas.	Plot No. 1, Irrigated every 7 days ...		15		31	6	17	4	49	15	
	" " 2, " 14 " ...		7		29	15	29	4	50	2	
	" " 3, " 28 " ...		4		23	14	35	8	50	5	
	" " 4, Unirrigated		*Nil.*		14	14	16	8	50	6.	

8. Upon the basis of the best result being obtained by irrigating once in a moon, Pundit Kali Sahai, Superintendent of Encumbered Estates, undertook another experiment to ascertain what amount of manure would give the maximum produce.

9. A pucca bigha of "goind mattiar" land was selected, and divided into 4 equal parts. To one part 32 maunds, to another 16 maunds and to the third 8 maunds of the same manure were given, *viz.*, the mixed stuff ordinarily used by natives. To the 4th part no manure was given. On each plot 13½ pucca seers of wheat were sown on the 3rd November 1874, and irrigated about once a month, *viz.*, on the 3rd of December, January and February. The quantity of grain and bhoosa produced was largest with the most manure, but the plot with 16 maunds of manure is shown to have given less grain and bhoosa, than those with 8 maunds, and with no manure. I think there is some source of error in this experiment, and probably it is due to the manure used in the 2nd plot not being so good as that used for the others.

10. Another pucca bigha of "doomat palon" land was selected and also divided in 4 parts. To one part 125 maunds, to another 62½ maunds, and to the 3rd 31¼ maunds of manure were given. To the 4th part no manure was given. On the 10th November 1874, 10 pucca seers of Cabul peas were sown, and irrigated about once a month, *viz.*, on the 9th December, 8th January and 11th February. In this case, the largest amount of grain and bhoosa was obtained, not from the most highly manured plot but from that to which 31¼ maunds were given, and the least was from the plot without any manure. The results of these experiments would point

(1st) to the undoubted advantage of manure

(2nd) to a limit of manure per bigha, by which a maximum of produce can be secured.

11. There has been lately a cry in favor of heavy manuring in order to increase the produce of the soil of this country. But besides the difficulty of obtaining large supplies of manure, it is very questionable whether, beyond a certain limit, it would be advantageous to manure heavily. Of course the limit for each kind of soil must be found by direct experiment, as well as for each kind of manure. There is no doubt that a large quantity of manure, with sufficient water would produce a very luxuriant crop. But luxuriance, beyond a certain limit, is no test of weight, when the crop is dried. Luxuriance may be largely due to excess of water in the tissues of the plant, and therefore on drying the produce, the water evaporates, and ceases to add weight to the crop.

12. These experiments are very interesting, and if conducted with ordinary care, and by intelligent persons would, in course of time, afford a number of valuable data.

13. The results of the two experiments are given herewith in a tabulated form with further details.

Experimental cultivation of crops for the purpose of ascertaining the amount of manure necessary to give the best results.

Name of place	Quality of soil and extent of ground	Quantity of manure in each plot.	Quality and quantity of seed sown.	Yield in pucca maunds. Grain. M.	S	C	Bhoosa. M	S.	C.	Number of waterings.	Remarks.
Lucknow Division. Itaunja.	"Goind muttiar" 1 pucca bigha divided into 4 equal plots ¼ bigha each.	1st plot 32 maunds.	13½ pucca seers of the same kind of wheat were sown on each plot on the same day, 3rd November 1874.	3	12	14	1	20	0	Each plot received a full watering on 3rd December 1874, 3rd January, and 3rd February 1875. There was drizzling for about 9 hours on the 15th February, and a good fall of rain on 14th February.	No injury by frost or any other cause. Cost of experiment Rs. 18 14 9; Sale of produce " 17 14 3; Rs. 1 0 6
		2nd plot 16 maunds		*2	29	4	1	5	0		
		3rd plot 8 maunds.		2	36	10	1	12	8		
		4th plot none.		2	36	10	1	12	8		
Gaddia.	"Doomut palon" a pucca bigha divided into 4 equals plots ¼ bigha each.	1st plot 125 maunds.	10 pucca seers of Cabul peas were sown on each plot on the 10th November 1874.	1	25	4	4	28	0	Each plot received a full watering on 9th December 1874, 8th January, and 11th February 1875. There was a shower of rain on the 7th and 8th February 1875.	No injury by frost or hail. Cost of experiment Rs. 13 12 6; Sale of produce " 8 9 0; Rs. 5 3 6
		2nd plot 62½ maunds.		1	31	0	4	10	0		
		3rd plot 31¼ maunds.		2	6	0	5	4	8		
		4th plot none.		1	18	4	2	18	0		
		N. B. mixed manure ordinarily used by natives.									* There appears to be some error here.

14. In the Central Jail the Superintendent Dr. McReddie planted some yams. A piece of ground, square yards 1,184 in extent, closely planted, yielded 14 maunds of yams. As we have no data of yam growing, the above record may be of some use.

8110